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J.M. GILBRETH
GILBRETH & ASSOCIATES, P.C.
P.O. BOX 2428
BELLAIRE, TX 77402-2428

EXAMINER	
BARRY, CHESTER T	

ART UNIT	PAPER NUMBER
1724	

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Please find below and/or attached an Office communication concerning this application or proceeding.

FILE COPY

Office Action Summary

Application No.	Applicant(s)
REISSUE AND REEXAM 09/733,392 90/005710	HAASE, RICHARD ALAN
Examiner	**Art Unit**
Chester T. Barry	1724

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION. 550(c)

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *3/1,4,19/02* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,10-16,19,20 and 22-71* is/are pending in the application.

4a) Of the above claim(s) *62-66* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,10-16,19,20,22-61 and 67-71* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☒ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Constructively Non-Elected / Withdrawn Claims

Claims 62 – 66, reciting a copolymer having an acrylamide "moity" [sic, moiety] and a quaternary ammonium moiety, are directed to the "method three" invention, which was non-elected following a restriction requirement under 35 USC 121 during the prosecution of the '435 patent. That restriction requirement is repeated here but

modified as follows: Method one and method two, having been examined in the patent's prosecution, are similarly joined together for examination here. Insofar as applicant has received an office action on the merits to claims directly solely to the previously elected method one and method two inventions, claimed 62 – 66 directed to a different invention are withdrawn from prosecution as having been constructively non-elected.

Claim objections:

Claim 4 is objected to under 37 CFR 1.121(b)(2) for want of the underlinings and bracketing to accurate reflect differences in the amended claim language vis-à-vis the text of the issued claim. Claim 4 as issued appears at the left. Claim 4 as amended in the Second Supplemental Response is provided below with the markings necessary to comply with the rule.

Claim 4 as issued	Claim 4 as amended with proper markings
4. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge and, upon formation of microflocs of the sludge from the polymeric quaternary ammonium compound, a cationic polyacrylamide is added to form a floc that dewaters the sludge.	4. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge and, upon formation of microflocs of the sludge from the polymeric quaternary ammonium compound, <u>wherein the polyacrylamide is</u> a cationic polyacrylamide <u>and</u> is added to form a floc that dewaters the sludge.

35 USC §112(1) Lack of Description / 35 USC §251 / 35 USC §132

Not adding / free of added "colloidal material"

Claims 23, 42, 49, 50, 56, 57 are rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed. Similarly, Claim 23 is objected to under 35 USC §251 and §132 for addition of impermissible new matter.

Importantly, applicant is reminded that one must define one's invention in terms by which applicant has described the invention, or using language going to a point which the skilled artisan would have understood applicant to have been in possession of even if not expressly described as such originally. Therefore, applicant's claim 23 is rejected under 112(1st parag.) for the application not having described the concept of not adding an anionic colloidal material "between the contacting" (whatever that means) (see corresponding §112(2nd) rejection). The issue is not whether the step of adding an anionic colloidal material "between the contacting" is absent from the express written description of the original disclosure: The examiner concedes that this is true. The issue is whether in this case applicant conveyed to the skilled artisan through his description his contemplation – and therefore his possession of – ***not*** adding ***in particular*** an anionic colloidal material. If silence alone were the test for ascertaining whether applicant was in possession of a negative limitation, i.e., whether he was in possession of not performing a specified act, for example, then Samuel Hopkins – to whom the first US patent was issued in 1790, would have had descriptive support for a process for making potash comprising inter alia "not controlling said process using a microprocessor-based proportion-integral-derivative control circuit."

Applicant is invited to cite column and line of the patent in support of the claimed invention. Description of the concept of "optionally adding an anionic colloidal material between the contacting," or the like, would, for example, implicitly give adequate support for the applicant's contemplation either adding or ***not adding*** that material. Upon review of the application as originally filed, the examiner could find no such passage having such an effect.

Claims 41 – 47, 49 are rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed of the claimed subject matter. Similarly, Claims 41- 47 are objected to under 35 USC 251 and 35 USC 132 for impermissible introduction of new matter.

"acrylamide"

Claim 41 recites a sludge comprising "acrylamide." While applicant may have support for a sludge comprising "polyacrylamide," nowhere could support for acrylamide be found. In claims 42, 43, and 49, there is no support for "anionic colloidal material."

Coexistence of microflocs, polyquat, and polyacrylamide?

Claim 50 is rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed. Claim 50 is limited in the alternative to contacting of the polyquat (coagulent or thermophile charge neutralization agent) and polyacrylamide (flocculent) simultaneousy. At the same time, however,

claim 48, from which claim 50 depends, requires the presence of "microflocs" rather than agglomerated microfloc materials. The skilled artisan would not have understood applicant to have been in possession of any such conditioned sludge to which both coagulent and flocculent has already been added and which continues to be characterized by an unagglomerated microfloc. See applicant's statement that the polyquat makes microflocs while the polyacrylamide joins the microflocs in a net thereby agglomerating them. Col 5 line 48. While applicant states that "[s]lower mixing" and "gentler agglomeration" results in optimal size and strength of the "flocs," applicant says nothing of "microflocs" after addition of the polyacrylamide. By that time, it's a floc – even if a sub-optimally sized one at short agglomeration times.

Polymer dosage based on "solids" or "thermophile" content?

Claims 28, 32, 37, 40, 46, 53, 60 are rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed, and objected to under 35 USC 132 and 35 USC 251 for addition of new matter.

The application as filed refers to a ratio of polymer dosage relative to "percentage of solids component of the sludge." See for example, column 6 lines 4 – 8, reproduced below for emphasis:

> In a thermophilic digested sludge with a solids component of 4.4 percent, a total polymer dosage requirement of near 950 ppm is shown. As the solids component of the sludge increases or decreases, the amount of polyquaternary amine and polyacrylamide increases or decreases proportionately. The polymer concentration to solids component ratio (the ratio of the total polymer dosage requirement to the percentage of solids component of the sludge) may vary from about 50 ppm:1 percent to about 300 ppm:1 percent, depending on the sludge type.

Nowhere in the application as filed did applicant convey to the skilled artisan his understanding that the "solids" component of the thermophilic digested sludge was limited to thermophiles. Rather, the skilled artisan would have understood that the thermophilic digestion process effected the killing of decidedly non-thermophilic, e.g., mesophilic, pathogenic organisms. If the pathogenic organisms were thermophilic, they would thrive rather than die in the thermophilic process, right? This view is supported by applicant's own disclosure if not the EPA Part 503 regulations themselves.

Chung '470 is cited (col 3) for the recognition that digested sludge contains not just bacteria and water, but also cellulosic and proteinaceous material.

Accordingly, the notion that the polymer dosage of 50 – 300 ppm is based on the ***thermophile*** content, rather than the broader concept of "solids" per se, is a new concept or definition not supported by the application as filed.

Simultaneous contacting of polyquat and polyacrylamide

Claims 22 – 32, 43, 50, 57 are rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed, and objected to under 35 USC 132 and 35 USC 251 for addition of new matter.

The application as filed does not describe the simultaneous contacting of the polyquat and polyacrylamide with the biological sludge. The phrase, "along with a cationic polyacrylamide," as in the following passage, does not mean, "added at the same time as."

> By the first method, the polyquaternary amine is added directly along with a cationic polyacrylamide, to the biological sludge.

(Abstract). Instead, it means, "in the same manner as a cationic polyacrylamdie is added directly." "[D]irectly" means "without mixture with other components prior to contacting with the biological sludge." This interpretation is supported by applicant's statements regarding the "method one" embodiment concerning addition of the polyacrylamide directly to the sludge after the microflocs have been formed. Specifically,

> Method one involves the addition of a polyquaternary amine directly to the sludge. . . . [O]nce the microflocs of sludge have formed from the polyquaternary amine, a cationic polyacrylamide is added to form a floc that will dewater well.

Column 5 lines 52-57.

35 USC § 112(1) – Lack of enablement

Coexistence of microflocs, polyquat, and polyacrylamide?

Claims 50 is rejected under 35 USC 112(1) as failing to teach how to made or use the invention. Further to the remarks in the preceding paragraph, it is equally unclear that applicant has taught the skilled artisan how to be himself in possession of such a sludge in this evanescent state. That is to say, the skilled artisan would have expected the existence of unagglomerated microflocs of thermophiles in the midst of both the polyquat and the polyacrylamide to be short-lived – even fleeting and elusive. Nothing in applicant's original disclosure has taught the skilled artisan how to create such coexistence. Even if it were shown that the skilled artisan would have expected coexistence of unagglomerated microflocs of thermophiles, polyacrylamide, and

polyquats, then the application is deficient for want of description of what additional steps must necessarily be taken to produce agglomerated flocs.

35 USC §112(2)

"di-allyl di-methyl ammonium chloride . . . family"

Claims 2, 26, 30 are rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought.

There does not appear to be an art-recognized appreciation for which compounds are included in the "di-allyl di-methyl ammonium chloride . . . family," nor does applicant provide any such definition of said "family." Clearly, the compound di-allyl di-methyl ammonium chloride would unquestionably be a member of any such "family," but this observation only begs the question: What compounds ***other than*** the compound di-allyl di-methyl ammonium chloride would also unquestionably be a member of such a "family"? Insofar as the answer to that query is anything but certain, claim 2 runs afoul of §112(2) for want of fair notice to the public of the property encompassed thereby. Similar grounds for rejection apply to claim 3 as well with respect to the so-called "epichlorohydrin di-methyl amine . . . family." Epichlorohydrin di-methyl amine appears to be but one compound. These rejections may be overcome by limiting the scope of the ammonium compound to di-allyl di-methyl ammonium chloride.

Similarly, per claim 26, the notion of DADMAC "compounds" is not understood: DADMAC is a single compound. Similarly, epi-DMA is a single compound, not a group or family of compounds.

Claims 44, 51 are rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. Claim 44 recites "di-allyl di-methyl ammonium chloride . . . compounds," but neither the art nor the application as filed shed light on which compounds fall within this group which are not the single compound di-allyl di-methyl ammonium chloride. Similarly, the same can be said for "epichlorohydrin di-methyl amine . . . compounds." chloride in claim 2 and by limiting the scope of the ammonium compound to epichlorohydrin di-methyl amine in claim 3. These remarks alone should not be taken as an indication of allowable subject matter.

Method or composition?

Claim 19 is rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. Claim 19 is ostensibly directed to a method, even though the claim from which it depends, namely, claim 15, is clearly directed to a composition of matter. While a reasonable effort has been made to reconcile this apparent inconsistency, such effort was to no avail, and could not render claim 19 reasonably precise in scope. Correction is

required. It is suggested that claim 19 be cancelled in response to this rejection that is substantially related to patentability.

"between the contacting"

Claim 23 is rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought.

The expression "between the contacting" cannot be understood insofar as only one contact step is recited.

Antecedence substantially related to patentability

Claims 43, 45, 47, 52 are rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. Claim 41, from which claim 43 depends, fails to describe the "polyacrylamide" recited in claim 43. Amendment from "polyacrylamide" to "acrylamide" would overcome this rejection, but see the new matter objection / rejection of claim 41 based on recitation of "acrylamide." Claim 41, from which claim 45 depends, also fails to describe the "cationic polyacrylamide" recited in claim 45. Amendment from "cationic polyacrylamide" to simply "acrylamide" would overcome this rejection, but see the new matter objection / rejection of claim 41 based on recitation of "acrylamide." See also claim 52. Claim 41, from which claim 47 depends, fails to describe the "polyacrylamide" recited in claim 47. Amendment from "polyacrylamide" to "acrylamide" would overcome this rejection, but see the new matter objection / rejection of claim 41 based on recitation of "acrylamide." Claim 48, from which claim 52 depends, also fails

to describe the "cationic polyacrylamide" recited in claim 52. Amendment from "cationic polyacrylamide" to simply "polyacrylamide" would overcome this rejection.

"thermophilic / thermophiles"

Claims 1-8, 10-16, 19-20, 22-61, 67-71 are rejected under §112, second paragraph, for failure to particularly point out and distinctly claim the invention. Each pending claim is limited in part by either a step of providing a sludge that has been digested by a "thermophilic" digestion process or by the presence of "thermophiles." The former limitation defines the temperature range at which the digestion process took place. The latter limitation is defined by activity of bacteria in a specific temperature range. Col 2 line 8-9 suggest that applicant understands "thermophilic" to being at about 115°F (about 46°C) while col 2 line 12 suggests that applicant understands "thermophilic" to being at about 131°F (about 55°C). It is unclear whether a sludge digested at a temperature more than about 46°C and less than about 55°C would qualify as a sludge that has been digested by a thermophilic process. Similarly, it is not reasonably clear to the skilled artisan whether a composition containing bacteria active at a temperature about 46°C but not active at about 55°C would meet the limitation of a "thermophile." Limitation to supported specific numerical temperature ranges (specifically recited in the claims) would overcome this rejection.

35 USC 103(a)

Dentel, Gould, and Buckman '269

Claims 1, 3 – 8, 10-16, 19-20, 22-61,67-71 are rejected under 35 USC 103(a) over Dentel, Gould, and Buckman.

DENTEL describes a commercial[1] method of enhancing the dewaterability of, i.e., "conditioning," an anaerobically digested biological sludge using two compounds added to the sludge: a quaternary ammonium halide cationic surfactant, i.e., hexadecyltrimethyl ammonium bromide, and a polyelectrolyte, i.e., Percol 757 brand polyacrylamide. No claim is limited to a sludge digested by an ***aerobic*** thermophilic digestion process.

a) thermophilic limitation

The claims require that the sludge be one that has been digested by a "thermophilic" process or, in the alternative, that the sludge contain thermophiles, i.e., bacteria active in the thermophilic temperature range. The specification states that at temperatures of at least about 115°F [at least about 46°C], the bacteria are of the "thermophilic variety."[2] The specification also suggests that applicant defines the beginning of the thermophilic temperature range at 131°F [55°C].[3] Notwithstanding this ambiguity with respect to applicant's intended understanding of the term "thermophilic temperature,"[4] it is clear that Dentel does not disclose the temperature at

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[1] East Bay Municipal Utility District, California
[2] Haase '435 col 2 lines 8-9.
[3] Haase '435 col 2 line 13.
[4] See the corresponding rejection under 35 USC 112 (2nd parag).

which the sludge was digested anaerobically. On this record, no inferences can be made as to the temperature range at which the sludge was anaerobically digested. The examiner's search did not reveal publicly available information as to the temperature at which the waste treatment facilities described in the Dentel report operated during the period studied by the Dentel team of investigators. Accordingly, Dentel does not meet applicant's limitation to "thermophilic" regardless of that term's specific meaning. It would have been obvious, however, to have first aerobically digested the sludge at 35 – 75°C and then anaerobically digested the sludge (as taught by Dentel), but at a temperature of 25-60°C in order to "further reduce the biodegradable volatile suspended solids content of the sludge," as taught by Gould (Abstract). Importantly, Gould recognizes that the major reasons for prior commercial acceptance of anaerobic sludge digestion (the type described in Dentel), was its ability to stabilize large volumes of dilute organic slurries, low production of biomass, methane production, and production of a relatively easily dewaterable sludge. Moreover, Gould suggests operating the anaerobic sludge digestion process at temperatures higher than the mesophilic temperature range, i.e., in the art's understanding of the "thermophilic" range, because methane forming bacteria have a relatively growth rate "***even*** at mesophilic temperatures" (Gould col 4 line 10)(emphasis added). Note in particular Gould disclosure of a synergistic benefit associated with the dual thermophilic aerobic-then-thermophilic anaerobic embodiment (col 10 lines 21+, line 30)

Furthermore, it would have been obvious to have substituted thermophilic aerobic digestion at 45 – 75 °C for Dentel;s anaerobic sludge digestion because Gould

teaches that approach as an alternative to the "foregoing methods" (Gould, col 4 lines 30-50, specifically at line 30). Among the "foregoing methods," of course, is the traditional anaerobic sludge digestion process like that of Dentel. The skilled artisan would have been motivated to adopt Gould's suggestion to use aerobic thermophilic sludge digestion in place of anaerobic mesophilic digestion at least in part because of Gould's teaching that thermophilic aerobic digestion produces stable biosolids and effectively eliminates pathogenic bacteria in the sludge. Shorter sludge retention, i.e., 3 – 10 days, is ant art-recognized benefit (col 5 line 30-32).

b) "polymeric" quaternary ammonium compound

The claimed invention requires that the added / contacting quaternary ammonium compound be a "polymeric" compound whereas the Dental quaternary ammonium compound appears to be monomeric.

Like applicant and Dentel, Buckman '269 is concerned with dewaterability of sewage sludge. Dentel uses a cationic surfactant in combination with a vinyl addition polymer, i.e., polyacrylamide. Buchman suggests using a three-way combination of

> 1) a polymeric quaternary ammonium halide compound (e.g., epi-DMA or "ionene polymers" e.g., DADMAC);
>
> 2) a cationic surfactant, e.g., alkyltrimethylammonium chloride col 4 l 60, e.g., hexadecyltrimethylammonium chloride col 10 line 45; and
>
> 3) polyacrylamide col 4 line 8,

to improve dewaterability of sewage sludge (col 2 line 10). It would have been obvious therefore, to have added epi-DMA or polyDADMAC to Dentel's two way combination of

a cationic surfactant and polyacrylamide to improve dewaterability even further, as suggested by Buckman '269.

The limitations not specifically addressed in the preceding paragraphs are deemed to have been obvious given the art-recognized status of relative proportions of components in formulations, and the like, as result-effective variables. Accordingly, their optimization would have been obvious.

Dentel, Gould, and Buckman '269, alone or further in view of Rosencrance or Hurlock

Claim 2 is rejected under 35 USC 103(a) over Dentel, Gould, and Buckman, alone or further in view of USP 6048438 to Rosencrance or USP 6025426 to Hurlock.

To the extent that none of Buckman and the three patents incorporated therein (USP 2261002 to Ritter, 2271378 to Searle, and 3489663 to Bayer) adequately suggest use of polyDADMAC, then they suggest use of compounds which are of the polyDADMAC "variety." Further still, given Buckman's teaching to use cationic quaternary ammonium chloride based polymers, it would have been obvious to have selected polyDADMAC as one such compound because USP 6048438 to Rosencrance or USP 6025426 to Hurlock describes polyDADMAC type compounds as effective sludge conditioners.

Chitakela and Chung

Claims 1, 2, 4, 7, 16, 22 - 32 are rejected under 35 USC 103(a) over Chitakela in view of Chung. CHITAKELA describes anaerobic digestion of a biological sludge, dual conditioning of the sludge through addition to the sludge of either ferric chloride or a cationic surfactant, i.e., a quaternary ammonium compound, hexadecyltrimethyl ammonium bromide, and a polyacrylamide polymer, e.g. PERCOL 757 brand cationic copolymer of polyacrylamide and quaternized dimethylaminoethylacrylate. The conditioned digested sludge is then dewatered. The use of either the quaternary ammonium compound and the polyacrylamide in combination or of the ferric chloride and the polyacrylamide in combination enhances the dewaterability of the sludge in comparison to use of no conditioner at all as well as use of the quaternary ammonium compound alone. As explained in the reference,

> The optimum dose of each conditioner[, e.g., either the ferric chloride or the quaternary ammonium compound HDTMA] occurred when the streaming current detector's reading was between –15 and –20. Although this degree of charge neutralization seemed necessary for good flocculation, it was not sufficient to guarantee a very low CST [capillary suction time]; for this, some amount of polymer was needed beyond the . . . HDTMA dose. The polymer enhanced dewaterability by some mechanism – such as bridging - - that was in addition to charge neutralization. Use of dual chemical conditioners reduced dose of either chemical used separately.

Chitakela, page 11-28 - 11-29. See also NALCO WATER HANDBOOK[5] for evidence that the skilled artisan would have understood "charge neutralization" as implicating coagulation by a "primary component" and "bridging" as implicating flocculation of

[5] Fig. 8.1 page 8.4.

charge neutralized, agglomerated colloidal particles. Per claim 4, CHITAKELA describes adding the polyacrylamide polymer directly to the sludge.

Although Chitakela does not explicitly describe the temperature regime at which the anaerobic digestion took place, but the skilled artisan would have understood that the anaerobic digestion spoken of in Chitakela would have taken place in any one of the only possible temperature regimes, i.e.,:

> a) the psychrophilic temperature regime (USP 4845034 to Menger, col 2 lines 8-20, but less likely in view of USP 5651890 to Trost, col 1 lines 45-50);
>
> b) the mesophilic temperature regime (USP 4845034 to Menger, col 2 lines 8-20, and more likely than the psychrophilic regime per USP 5651890 to Trost, col 1 lines 45-50), or
>
> c) the thermophilic temperature regime (USP 4845034 to Menger, col 2 lines 8-20, and more likely than the psychrophilic regime per USP 5651890 to Trost, col 1 lines 45-50).

The skilled artisan, therefore, upon reading Chitakela's description of an anaerobic digestion process – albeit silent on the question or temperature - would have nonetheless "at once envisage[d]" each of the three temperature regimes, psychrophilic, mesophilic, and thermophilic, each one viewed independently of the others. In re Petering, 133 USPQ 275 (CCPA 1962).

Chitakela does not anticipate claim 1, however, because the cationic quaternary ammonium compound is not a ***polymeric*** quaternary ammonium compound. Given the aliphatic cetyl group (aka hexadecyl-) of the HDTMA compound, the skilled artisan would not have expected this compound to polymerize upon mixing with water. The molecular weight of the compound is described as 364.5 (page 11-26) which stands as

further evidence that the compound is non-polymeric. Finally, the skilled artisan would have readily appreciated that the cetyl group ($C_{16}H_{33}$-) is a hydrophobic group.

Like Chitakela, Chung also is directed to conditioning aqueous waste prior to chemical dewatering (col 2 lines 22-25). Chung describes adding a hydrophobic polymer coagulent followed by a cationic polyacrylamide copolymer flocculent (col 5 line 2, "AcAm") before dewatering. The hydrophobic coagulent is preferably a hydrophobically modified diallyldimethylammonium chloride copolymer. Chung teaches that the hydrophobic monomer may include an aliphatic c4 – c20 chloride (col 3 line 34).

Given the "dual conditioning" approach taken by both references, ie., addition of an ammonium halide compound as a primary component / coagulent followed by addition of a polyacrylamide flocculent, and given further the close structural similarities[6] of Chitakela's hexadecyltrimethylammonium bromide and Chung's hydrophobic polyDADMAC, the skilled artisan would have had a reasonable expectation of success in substituting Chung's polymeric ammonium halide material for Chitakela's monomeric ammonium halide compound. Accordingly, it would have been obvious to have substituted Chung's polymeric hydrophobic-modified quaternary diallyldimethyl ammonium chloride for the monomeric cetyltrimethylammonium bromide described in Chitakela.

With respect to claim 16, Chitakela describes the ferric chloride as a solution, HDTMA as a 4% solutrion (p. 11-26) and the polyacrylamide as a solution (page 11-26). Upon substitution of polyDADMAC or poly(epi-DMA) for the HDTMA or ferric chloride, it

[6] hydrophobic C4 – C20 aliphatic side group, dimethyl vs. trimethyl, both are ammonium halides.

would have been obvious to have formulated it as a solution in following the Chitakela teaching of a cationic coagulent solution.

. . . and Ghosh

Claim 14 is rejected under 35 USC 103(a) over Chitakela in view of Chung, as set forth above, further in view of USP 4329428 to GHOSH. Ghosh suggests mixing biological sludge with primary sludge prior to feeding to a thermophilic digestion process. In view of the widespread practice of recirculating incompletely digested solids to upstream processing stages to effect further digestion, it would have been obvious to have recirculated undigested or incompletely digested biosolids again through the digestion reactor. In doing so, it would have been obvious to have mixed the incompletely digested solids with primary sludge, as suggested by Ghosh.

Chitakela and Carlson

Claims 1 – 4, 7,16, 22 – 32 are rejected under 35 USC 103(a) over Chitakela in view of USP 5451326 to Carlson. The discussion of Chitakela above is incorporated herein by reference, but with the following additional remarks: Chitakela also describes an embodiment in which sludge conditioning is accomplished by the addition of ferric chloride as the coagulent and polyacrylamide polymer as the flocculent. The difference between the Chitakela prior art and the claimed invention, therefore, is that the coagulent is ferric chloride in the prior art and a polymeric quaternary ammonium compound in the applied for invention. CARLSON, like Chitakela and applicant, is also

directed to conditioning waste solids prior to dewatering (col 2 lines 20 – 25). Carlson teaches the functional equivalence of ferric chloride and polydiallyldimethyl ammonium chloride (col 6 line 30). Carlson also teaches the functional equivalence of ferric chloride and epi-DMA (col 6 line 30). Accordingly, it would have been obvious to have substituted polyDADMAC or epi-DMA for the ferric chloride described in Chitakela.

With respect to claim 16, Chitakela describes the ferric chloride as a solution, HDTMA as a 4% solutrion (p. 11-26) and the polyacrylamide as a solution (page 11-26). Upon substitution of polyDADMAC or poly(epi-DMA) for the HDTMA or ferric chloride, it would have been obvious to have formulated it as a solution in following the Chitakela teaching of a cationic coagulent solution.

. . . and Ghosh

Claim 14 is rejected under 35 USC 103(a) over Chitakela and USP 5451326 to Carlson, as applied above, further in view of USP 4329428 to Ghosh. Ghosh suggests mixing biological sludge with primary sludge prior to feeding to a thermophilic digestion process. In view of the widespread practice of recirculating incompletely digested solids to upstream processing stages to effect further digestion, it would have been obvious to have recirculated undigested or incompletely digested biosolids again through the digestion reactor. In doing so, it would have been obvious to have mixed the incompletely digested solids with primary sludge, as suggested by Ghosh.

Chitakela and Hassick or Huang

Claims 1 – 6, 7,16, 22 – 32 are rejected under 35 USC 103(a) over Chitakela in view of USP 5035808 to Hassick or USP 4450092 to Huang. As noted in the discussion

of Chitakela above (incorporated herein by reference), Chitakela describes addition of ferric chloride followed by polyacrylamide to the sludge followed by dewatering. Hassick teaches that it was known to coagulate suspended solids from aqueous waste streams using ferric chloride or cationic polymers individually. Accordingly, Hassick suggests substituting a cationic polymer, e.g., epi-DMA or DADMAC (col 2 line 60, 65) for the ferric chloride described by Chitakela. Moreover, Huang or Hassick suggests substituting a combination of both ferric chloride and either epi-DMA or DADMAC in place of ferric chloride alone in order to achieve a "synergistic benefit" (Hassick, col 3 line 44).

With respect to claim 5, Percol 757 appears to have a relatively high molecular weight. The molecular weight of the DADMAC suggested by Huang has a molecular weight as low as 2000. It would appear that the PERCOL 757 has a molecular weight higher than 100,000 (col 2 line 30) and certainly higher than 2000. As for the relative amounts of the polyquat and the polyacrylamide, e.g., claims 5 and 6, Chitakela teaches that tradeoffs can be made by changing the proportion of the coagulent and the "bridging" flocculent. Insofar as the relative amounts of two components in a dual conditioning system are clearly recognized as known result effective variables, variation and optimization thereof is obvious. Similarly, per claim 7, the total amount of conditioning polymers added - that is, the conditioning polymer dosage – is also a well known result effective variable. Accordingly, its optimization would have been suggested to the skilled artisan.

With respect to claim 16, Chitakela describes the ferric chloride as a solution, HDTMA as a 4% solutrion (p. 11-26) and the polyacrylamide as a solution (page 11-26). Upon substitution of polyDADMAC or poly(epi-DMA) for the HDTMA or ferric chloride, it would have been obvious to have formulated it as a solution in following the Chitakela teaching of a cationic coagulent solution.

. . . and Ghosh

Claim 14 is rejected under 35 USC 103(a) over either Chitakela and Hassick or Chitakela and Huang, as applied above, further in view of Ghosh '428. Ghosh '428 suggests mixing biological sludge with primary sludge prior to feeding to a thermophilic digestion process. In view of the widespread practice of recirculating incompletely digested solids to upstream processing stages to effect further digestion, it would have been obvious to have recirculated undigested or incompletely digested biosolids again through the digestion reactor. In doing so, it would have been obvious to have mixed the incompletely digested solids with primary sludge, as suggested by Ghosh.

Chitikela and Buckman

Claims 15, 19, 33 – 40 are rejected under 35 USC 103(a) as being obvious over Chitakela in view of USP 4250269 to Buckman. Claim 15 is directed not to a dewatering method, but rather to a composition of matter. The claimed composition comprises a biological sludge that has been digested by a thermophilic digestion process, a polymeric quaternary ammonium compound, and polyacrylamide. Chitakela

describes a biological sludge that has been digested by a digestion process ("anaerobically digested sludge") ("thermophilic" would have been "at once envisaged" by the skilled artisan given the small number (3) of possibilities, In re Petering, *supra*), a ***non***-polymeric quaternary ammonium compound, i.e., a cationic surfactant "HDTMA," and polyacrylamide.

Buckman teaches that an admixture of a polymeric quaternary ammonium compound, e.g., epichlorohydrin-amine, a vinyl-addition polymer, e.g., cationic polyacrylamide, and a cationic surfactant, can be useful in dewatering sewerage sludge and improve drainage in the pulp and paper industry. Col 1 lines 5-15.

As noted above, Chitikela describes polyacrylamide and a cationic surfactant in his admixture. It would have been obvious to have added a polymeric quaternary ammonium compound, e.g., epi-DMA, to the Chtikela composition in order to improve sludge dewatering, as suggested by Buckman. Insofar as polymeric quaternary ammonium compounds and polyacrylamide were known to facilitate dewatering of thermophilic digested sludges independently, as shown for example by applicant's admissions and Chitakela, respectively, it appears that any combination of these two materials would have met the recited limitation of "being present in a ratio to enable dewatering of the biological sludge." The aforementioned "dewatering" is not qualified or limited by extent of dewatering or time required to meet a predetermined level of solids dryness. Applicant should not construe this last remark as an indication of allowable subject matter.

The limitations not specifically addressed in the preceding paragraphs are deemed to have been obvious given the art-recognized status of relative proportions of components in formulations, and the like, as result-effective variables. Accordingly, their optimization would have been obvious.

Claim Observations

It is noted that claims 47 and 54 are implicitly limited by an ***anionic*** polyacrylamide because it is only the anionic form of polyacrylamde for which the 5 000 000 to 15 000 000 MW range is supported. Compare column 6 line 25 with col 5 line 62 (stating that the cationic polyacrylamide has a MW range of 5 000 000 to ***16*** 000 000) (emphasis added).

Art Cited of Interest

USP 5200482 to Gartner is cited of interest.

USP 4710304 to Lang is cited for its disclosure that PERCOL 757 is described in USP "4,1[sic, 3]96,513."

USP 4396513 to Haldeman is cited for having been cited in Lang.

USP 5580550 to Gough is cited for the recognition that polymeric DADMAC is recognized as being a cationic surfactant (col 6 line 31) that is also known to be a functional equivalent of hexadecyltrimethylammonium chloride (col 6 line 12,19-20) (it is known that cetyl- means hexadecyl-) albeit in the role of a hair conditioning agent rather than as a sludge coagulent.

Response to Arguments

Applicant's arguments were carefully considered, but are mot in light of the new grounds of rejection.

Respectfully,

Chester T Barry

703-306-5921

7/24/02